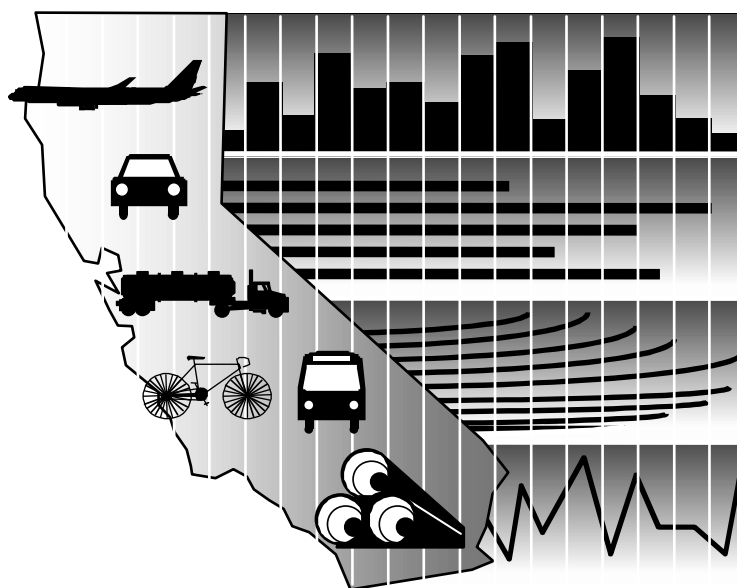


California Department of Transportation
Transportation System Information Program

Transportation System Performance Measures Sustainability

Definition Report



Booz·Allen & Hamilton Inc.
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EXECUTIVE SUMMARY

Sustainability is one of nine original outcomes in the performance measurement initiative being led by Caltrans. Proof-of-concept testing was already conducted based on an original definition and candidate measure, however, the definition and indicator did not satisfy the concept of sustainability. Therefore, with the recommendation of the System Measures Working Groups (SMWG) and approval of the Policy Advisory Committee (PAC), this outcome was separated into two outcomes: Sustainability and System Preservation. System Preservation is the subject of a separate report. A new definition for Sustainability has been developed, and a list of potential candidate indicators have been identified. Proof-of-concept testing is currently underway for selecting the appropriate indicators to measure sustainability. The following definition has been adopted by the PAC:

- *A sustainable transportation system meets the basic mobility and accessibility needs of current and future generations.*

This document summarizes, in some detail, the process by which this new definition for sustainability was developed.

The original definition of sustainability approved by the PAC focused on the condition of the transportation system now and in the future. The definition recognized two components: system preservation and needs. The original definition for the outcome was:

- *Preserving the transportation system while meeting the needs of the present without compromising the ability of future generations to meet their own needs.*

To measure sustainability, a candidate indicator, *household transportation costs*, was proposed. Two approaches, a transportation systems approach and a user expenditures approach, were considered for estimating current and future household costs. Limitations were found with both approaches. The PAC determined that neither approach tied agency or user costs to the present or future condition of transportation infrastructure.

As a result of the initial indicator testing and SMWG recommendations, the PAC decided to revisit the sustainability outcome and focus on system preservation as a new outcome. The SMWG recommended that the sustainability outcome be renamed "Transportation System Preservation." They also recognized the need to continue research on the sustainability outcome. It was suggested that the portion of sustainability not captured by other measures is the stewardship of the natural and human environment.

During early 2001, the internal and external SMWG worked on developing a definition of sustainability that focused more on stewardship than the preservation of the system,

which had become a separate outcome. Based on a literature review and multiple discussions with the SMWG, several items were proposed as important components of sustainability. Each component was grouped under three headings: Economic/Business, Social, and Environmental.

A subcommittee on sustainability was formed to further define sustainability and to help the SMWG make recommendations to the PAC. The subcommittee began developing a definition for the outcome by identifying issues important to sustainability. The subcommittee agreed that sustainability involves generational issues and therefore crosses several Performance Measures outcomes. Furthermore, they agreed that sustainability should be measured by trends over an extended time horizon. Because sustainability is not limited to geographic boundaries, modeling should occur at the highest possible level (i.e., state level). In addition to a statewide focus, the outcome should use existing data that is easy to understand, comprehensive, and useful.

Based on extensive review of other organizations' definitions of sustainability, the subcommittee developed a definition for the sustainability outcome that best represents Caltrans' role in sustainability. The definition recommended to the PAC for adoption was:

- *A sustainable transportation system meets the basic mobility and accessibility needs of society and individuals while balancing and stewarding current and long-term goals without compromising the needs of future generations.*

The definition was presented to the PAC in May. The PAC revised the definition to be more concise (the revised and adopted definition is presented on page i). The PAC also suggested that a presentation of the important components of sustainability along with the definition would provide a framework for the definition.

The PAC-adopted definition was presented to the external SMWG in June. Most members agreed that the definition was acceptable with the understanding that important components of sustainability would also be listed. Additionally, the SMWG agreed that a revised definition should be presented to the PAC, if warranted, after a review of possible indicators.

In addition, three categories (economic/business, social, and environmental) were presented to the SMWG, along with possible indicators grouped under each category. Several members recommended that the environmental category be renamed "environmental/resources" to take into account resource consumption.

The SMWG recommended that the subcommittee further explore each of the subcategories and indicators based on a review of potential outputs for the possibility of measuring the indicators. The subcommittee is pursuing the identification of various

outputs and available data sources. Following proof-of concept testing and SMWG review, appropriate candidate indicators will be recommended to the PAC.

1. DEVELOPMENT OF A DEFINITION OF SUSTAINABILITY

Sustainability is one of nine original outcomes in the performance measurement initiative being led by Caltrans. Proof-of-concept testing was already conducted based on an original definition and candidate measure, however, the definition and indicator did not satisfy the concept of sustainability. Therefore, with the recommendation of the System Measures Working Groups (SMWG) and approval of the Policy Advisory Committee (PAC), this outcome was separated into two outcomes: Sustainability and System Preservation. System Preservation is the subject of a separate report. A new definition for Sustainability has been developed, and a list of potential candidate indicators have been identified. Proof-of-concept testing is currently underway for selecting the appropriate indicators to measure sustainability. The definition adopted by the PAC is presented in Exhibit 1.

Exhibit 1: Adopted Sustainability Outcome Definition

OUTCOME: SUSTAINABILITY	
Definition	A sustainable transportation system meets the basic mobility and accessibility needs of current and future generations.
Candidate Measures	Various indicators grouped under three categories: Economic/Business, Social, Environmental

This report discusses the current status of the Sustainability outcome. It also provides a background discussion on the transition that the sustainability outcome has undergone during the process of developing the outcome definition (shown in Exhibit 1) and proof-of-concept testing.

1.1 Original Definition

The original definition of sustainability considered by the PAC focused on the condition of the transportation system now and in the future. The definition recognized two components: system preservation and needs. Preservation requires that the system be monitored over time. Needs, on the other hand, are more difficult to identify and define because future needs may not be possible to identify. Exhibit 2 presents the original definition of sustainability and the original candidate measure.

Exhibit 2: Original Sustainability Outcome Definition

OUTCOME: SUSTAINABILITY	
Definition	Preserving the transportation system while meeting the needs of the present without compromising the ability of future generations to meet their own needs.
Discussion	This requires the ability to monitor system conditions and forecast funding needs for replacement, rehabilitation, and repair so that today's investments provide maximum value and efficiency over time.
Candidate Measures	Household Transportation Costs

Sustainability is emerging as a term with broad meaning in the transportation planning literature. Booz·Allen & Hamilton reviewed a number of sources to determine how other organizations define sustainability. None of the sources reviewed define sustainability in the exact manner as directed by the PAC. Most of the literature reviewed identified a larger context for sustainability. Other organizations and academics emphasize equity, protection of the natural environment, incentives for more efficient land use, and reduction of natural resource consumption. Several of these issues are covered to a certain extent by the Environmental Quality and Equity outcomes. For example, the American Planning Association includes the following elements in their definition of sustainability:

- Inter- and intra-generational equity
- Protecting and living within the natural carrying capacity of the natural environment
- Minimization of natural resource use
- Satisfaction of basic human needs.

1.2 Original Candidate Measure

To measure sustainability, a candidate indicator, *household transportation costs*, was proposed. The definition and discussion of the indicator is presented in Exhibit 3.

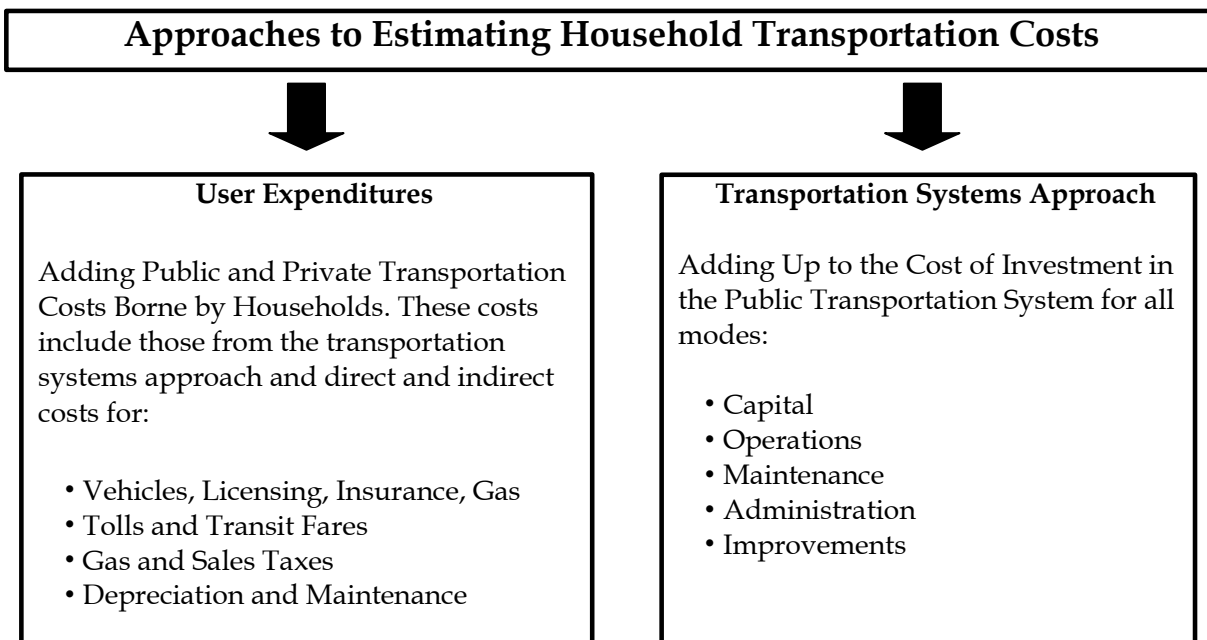
Exhibit 3: Candidate Measure Definition

CANDIDATE MEASURE: HOUSEHOLD TRANSPORTATION COSTS	
Definition	The average percentage of household resources dedicated to transportation over a period of time.
Discussion	This measure reflects total user costs as a proportion of user income. If it increases significantly over time, future generations will spend more on transportation and less on other economic activities.

1.3 Approaches

Two approaches, a user expenditures approach and a transportation systems approach, were considered for estimating current and future household costs. The user expenditures approach measured these costs indirectly by considering public agency expenditures which are ultimately financed by taxpayers, while the transportation systems approach attempted to measure household transportation costs directly. These approaches are presented in Exhibit 4.

Exhibit 4: Candidate Approaches Proposed



Limitations were found with both approaches. The user expenditure approach was difficult to forecast due to external factors over which decision makers have little influence. For example, major elements of total user costs (e.g., automobile costs, gasoline costs, fare structures, insurance, sales taxes, gasoline taxes) are extremely difficult to forecast. The transportation systems approach provided an alternative to the user expenditures approach by measuring household costs indirectly through agency budgets. Agency transportation costs alone, however, did not adequately reflect sustainability for three reasons: agency budgets do not reflect changes in infrastructure conditions, agency budgets are affected by policy-driven funding decisions, and agency budgets are affected by operations costs. The PAC determined that neither approach tied user or agency costs to the present or future condition of transportation infrastructure.

1.4 New Direction

As a result of the initial indicator testing and SMWG recommendations, the PAC decided to revisit the sustainability outcome and focus on system preservation as a new and separate outcome. The original indicator, *average percentage of household resources dedicated to transportation*, did not consider the relationship between cost and infrastructure condition. Additionally, present and future needs could be defined in many different ways and were not easily measured. The SMWG decided to focus on preservation and recommended that the sustainability outcome be renamed “Transportation System Preservation.” The groups also suggested that the outcome definition be modified to reflect the preservation focus.

The SMWG recognized the need to continue research on the sustainability outcome. They acknowledged that the public is also interested in other aspects of sustainability, such as the transportation/land-use balance and stewardship of the natural environment. Some of these aspects are already captured under other outcomes, such as Equity and Environmental Quality. It was suggested that the portion of sustainability not captured by other measures is the stewardship of the natural and human environment. These issues were explored during subsequent sustainability subcommittee meetings and will be discussed in the remainder of this report.

1.5 Further Research on Sustainability

During early 2001, the Internal and External SMWG worked on developing a definition of sustainability that focused more on stewardship than the preservation of the system, which had become a separate outcome. Several definitions from a review of governmental, nonprofit, and academic literature provided a foundation for discussing the sustainability outcome. Based on the literature review and discussions with the SMWG, several items were proposed as important components of sustainability. Each component was grouped under three headings: Economic/Business, Social, and Environmental. The SMWG agreed that these three broad categories comprise the main elements of sustainability. These categories are presented in Exhibit 5.

Exhibit 5: Potential Sustainability Components

Economic/Business	Social	Environmental
▸ Business Activity	▸ Equity	▸ Pollution Prevention
▸ Employment	▸ Human Health	▸ Climate
▸ Productivity	▸ Education	▸ Habitat Preservation
▸ Tax Burden	▸ Community	▸ Aesthetics
▸ Trade	▸ Quality of Life	

The potential components were presented to the SMWG for review. The groups suggested additional items that should be considered a part of sustainability. These are presented in Exhibit 6.

Exhibit 6: Additional Sustainability Components

Economic/Business	Social	Environmental
▸ Operations Costs	▸ Minimum Land Consumption	▸ Environment
▸ Optimized Cost Benefit	▸ Jobs/Housing Balance	▸ Global Warming
		▸ Fuel Conversion
		▸ Fuel Source
		▸ Dollars vs. Natural Resources

The SMWG proceeded to consider three main options for the sustainability outcome. The first option was to focus on a specific definition of sustainability, such as longitudinal equity (i.e., sustainability over time, such as percent of household income), long lasting environmental damage (e.g., global warming and nuclear waste), and stewardship of the transportation system (i.e., resource utilization efficiency, long term societal impacts). Another option was to conduct additional research on sustainability to discover other directions to take, such as an emphasis on land use. Finally, some members of the SMWG considered dropping the sustainability outcome altogether.

The SMWG decided that eliminating the outcome was inappropriate because the concept of sustainability includes certain elements that are not covered by other outcomes. The SMWG also concluded that sustainability possibly includes all of the elements in the first option and that further research (option 2) on each of these issues

would help to narrow the focus of the outcome. In order to explore these options further, the SMWG decided to form a subcommittee on sustainability.

1.6 Subcommittee Discussions

The subcommittee on sustainability was formed to further define sustainability and to help the SMWG make recommendations to the PAC. The first meeting was held on April 9, 2001, and included one member from each of the following Caltrans programs/districts: Planning, Operations, New Technology, and District 3. The subcommittee also included two representatives from the Transportation System Information Program (TSIP) and a consultant from Booz-Allen & Hamilton who were present to facilitate the meeting.

The subcommittee began developing a definition for the outcome by identifying issues important to sustainability. The subcommittee agreed that sustainability involves generational issues and therefore crosses several Performance Measures outcomes. Furthermore, they agreed that sustainability should be measured by trends over an extended time horizon. This involves modeling future impacts while monitoring the current state of the system. Because sustainability is not limited to geographic boundaries, modeling should occur at the highest possible level (i.e., state level). In addition to a statewide focus, the outcome should use existing data that is easy to understand, comprehensive, and useful. Although Caltrans may not have all the data needed internally, data can also be obtained from other state, regional, and local agencies, as well as nonprofit and academic organizations.

Particular attention was paid to the issue of land use. The subcommittee agreed that land use cannot be excluded from transportation. Caltrans has the option to monitor and report on regional and local land use issues. Such a role would require a definition of smart land use and the monitoring of changes in relation to the definition.

The subcommittee also concluded that areas where sustainability overlaps with other outcomes should be identified in order to keep the sustainability outcome focused. Although it is acceptable for outcomes to overlap, it is important to identify what the sustainability outcome should embrace in comparison to the other outcomes. For example, the Safety/Security Outcome may focus on the current safety of the system, while the sustainability outcome looks at the health and safety of the State over the long term.

Overall, the subcommittee concluded that sustainability is a vision that we as a society will face in the future. Sustainability presumes the continuation of the species to a desired end (e.g., air quality can be monitored today and protected into the future). This means that we must consider what the long term consequences are of the decisions we make now. Decisions must also take into account the different needs of and impacts on urban and regional areas. The State should have a major role in defining and working with sustainability. Furthermore, Caltrans is not just a developer; it is a leader

in transportation and should be so in sustainability. Caltrans' task is to be a role model of sustainability in terms of transportation.

1.7 Potential Definitions

Several definitions of sustainability were identified during the literature review. Two definitions were reviewed extensively as potential frameworks from which to develop a definition for the sustainability outcome. The first definition of sustainability was developed by the Southern California Association of Governments (SCAG). The definition is the current definition in use by SCAG for their own series of performance measures. SCAG's definition includes both a definition and an explanation of important characteristics of a sustainable transportation system, grouped by three broad categories (economic growth, social equity, environmental). Exhibit 7 presents SCAG's definition of sustainability.

Exhibit 7: SCAG's Definition of Sustainability

Definition		
A sustainable transportation system meets the mobility and accessibility needs of the society while balancing the current and long term goals of economic growth, environmental quality and social equity without compromising the needs of future generations		
Economic Growth	Social Equity	Environmental
▶ Develop/maintain a system that operates efficiently	▶ Offers adequate access to opportunities by all segments of the society	▶ Minimize pollution
▶ Meet the long term economic needs of the society	▶ Offers affordable transportation system for all	▶ Minimize environmental disruption for human and non-human forms of life
▶ Complement economic activities and support a vibrant economy	▶ Offers choice by mode	▶ Minimize use of non-renewable energy sources
		▶ Promote recycling

The subcommittee also reviewed a definition from the Centre for Sustainable Transportation. The Centre's mission is to provide leadership in achieving sustainable transportation in Canada by facilitating cooperative actions, and thus contributing to Canadian and global sustainability. It defines a sustainable transportation system as one that:

- *Allows the basic access needs of individuals and societies to be met safely and in a manner consistent with human and ecosystem health, and with equity within and between generations*
- *Is affordable, operates efficiently, offers choice of transport mode, and supports a vibrant economy*
- *Limits emissions and waste within the planet's ability to absorb them, minimizes consumption of non-renewable resources, reuses and recycles its components, and minimizes the use of land the production of noise.*

Through a comparison of the definitions, the subcommittee determined that both definitions included basically the same components. The most significant difference was that the Centre's definition included noise, land use, safety, and health, whereas SCAG's definition did not. All of these issues, especially land use, were deemed to be important by the subcommittee. In another difference, the SCAG definition discussed "economic growth," while the Centre's definition called for a vibrant economy. In a discussion with the SMWG, members concluded that economic growth is not necessarily the same as a vibrant economy. Furthermore, members noted that an economy may be sustainable (vibrant) without actually growing. SMWG members agreed that this issue should be explored further as indicators of sustainability are identified.

Based on extensive review of each of the definitions, the subcommittee developed a definition for the sustainability outcome. The subcommittee identified the importance of formulating a unique definition to best represent Caltrans' role in sustainability in California. The definitions from SCAG and the Centre served as models for the development of the Sustainability outcome's definition. The definition recommended to the PAC for adoption was:

- *A sustainable transportation system meets the basic mobility and accessibility needs of society and individuals while balancing and stewarding current and long-term goals without compromising the needs of future generations.*

The definition was presented to the PAC in May. The PAC revised the definition to be more concise. The PAC also suggested that a presentation of the important components of sustainability along with the definition would provide a framework for the definition. The definition adopted by the PAC is presented in Exhibit 8.

Exhibit 8: Adopted Sustainability Outcome Definition

OUTCOME: SUSTAINABILITY	
Definition	A sustainable transportation system meets the basic mobility and accessibility needs of current and future generations.
Candidate Measures	Various indicators grouped under three categories: Economic/Business, Social, Environmental

The PAC definition was presented to the external SMWG in June. Most members agreed that the definition was acceptable with the understanding that important components of sustainability would also be listed. Additionally, the SMWG agreed that a revised definition should be presented to the PAC, if warranted, after a review of possible indicators.

In addition, three subcategories (economic/business, social, and environmental) were presented to the SMWG, along with possible indicators grouped under each category. Several members recommended that the environmental category be renamed “environmental/resources” to take into account resource consumption. The categories and representative indicators under consideration as of the date of this report are presented in Exhibit 9.

Exhibit 9: Proposed Sustainability Subcategories

Economic/Business	Social	Environmental/Resources
▸ Business Activity	▸ Equity	▸ Pollution Prevention
▸ Employment	▸ Human Health	▸ Climate
▸ Productivity	▸ Education	▸ Habitat Preservation
▸ Tax Burden	▸ Community	▸ Aesthetics
	▸ Quality of Life	

2. NEXT STEPS

The SMWG recommended that the subcommittee further explore each of the subcategories and indicators based on a review of potential outputs for the possibility of measuring the indicators. For example, habitat preservation may be measured by several outputs, such as the number of mitigated acres or the acres of ecological preserves. The subcommittee is pursuing the identification of various outputs and available data sources.

The focus of proof-of-concept testing will be to analyze the proposed indicators of sustainability. Local, regional, and state organizations from which to obtain the data necessary to calculate the indicators will be identified. The subcommittee will also analyze how the data could be used to track sustainability over time, determine the applicability of the data to the state or regional level, and identify any data manipulation required. Case studies of other states will provide valuable supporting information.

Following proof-of concept testing and SMWG review, appropriate candidate indicators will be recommended to the PAC. These recommendations will include an identification of the available data sources and the process necessary for calculating the indicators at the state and regional level. The tasks and recommendations identified in this section will be presented in a separate report.